TBAC Charge

Given your borrowing forecasts for the next two fiscal years, please comment on how Treasury should consider adjustments to coupon issuance sizes in the coming quarters. When should Treasury consider making adjustments to nominal coupon auction sizes, and how should these adjustments be allocated across the curve?

August 2021

Outline

1. Framework for Addressing TBAC Charge
2. Projection of Funding Needs
3. Coarse Auction Resizing Scenarios
4. Demand Assessment of Auction Points
5. Fine Tuning Auction Adjustment Scenarios
6. Additional Considerations
7. Conclusions and Recommendations
8. Appendix

1. Framework for Addressing TBAC Charge

Framework for Addressing TBAC Charge

- To address the questions of when and by how much Treasury should alter future coupon bond issuance a model has been used to estimate how overfunded Treasury would be under the current auction schedule and an assumed path of fiscal spending and SOMA management. This provides a baseline estimate of how much coupon issuance needs to be reduced.
- When analyzing auction adjustments, we considered the following:
  - The goal of maintaining regular and predictable issuance patterns while ensuring sufficient liquidity at existing nodes
    - While the issuance tables shown throughout the analysis are in annual terms, the underlying auction adjustments were implemented in a monthly regular and predictable fashion (e.g., consistently reducing an auction point by $1 billion each month, beginning in the first month of the year, reduces annual issuance by $78 billion in the first year, and then $144 billion in future years)
  - The goal to target T-bills within a long-term range of 15% to 20% of total debt outstanding
  - The impact on overall profile of the outstanding debt (WAM, duration and belly share*)
    - Given the TBAC Optimal Debt Model's preference for increasing belly share, we track this statistic throughout the analysis
  - The relative cost of each issuance point and the expected overall cost of issuance
- We evaluated different issuance scenarios under consistent fiscal spending and SOMA management assumptions.
- The scenarios are intended to assist in the decision of when and how issuance should be reduced over the next several years, and more broadly, the debt issuance strategy going forward.

Assumptions for Addressing TBAC Charge

- The following assumptions have been made in each of the scenarios:
  - The Fed's net new purchases of Treasuries are assumed to decline linearly by $6.7 billion per month between January 2022 and December 2022, and reinvestment of maturing debt is continued over the projection horizon
  - The fiscal spending requirements use the CBO budget projections (as of July 2021) with an adjustment of $1.5 trillion for additional fiscal packages not included in that baseline
  - Unless otherwise stated, SOMA holdings are included within the measures of the outstanding Treasury debt
    - For the purposes of calculating duration and WAM, SOMA holdings are treated as FRNs with the same maturities
  - 2-year FRN issuance is held constant at current levels
  - Treasury General Account (TGA) is held constant at current levels throughout the projection period
  - T-bills are issued as needed to meet the overall funding requirements in each coupon auction scenario

** Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.*

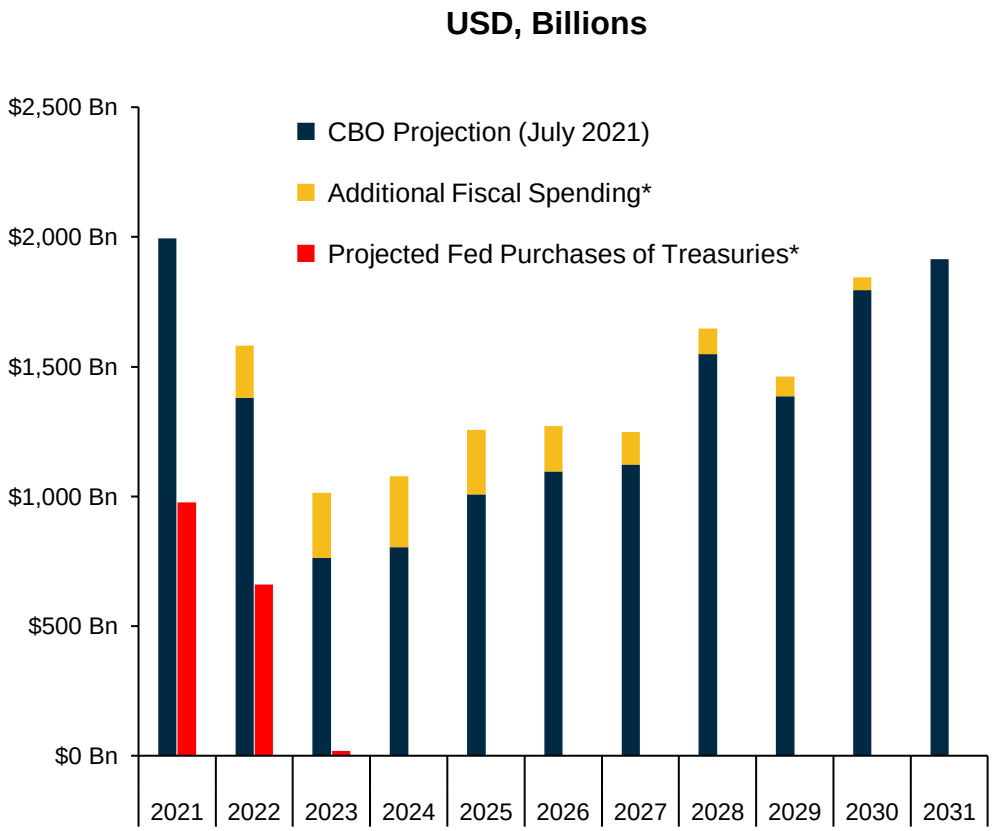
2. Projection of Funding Needs

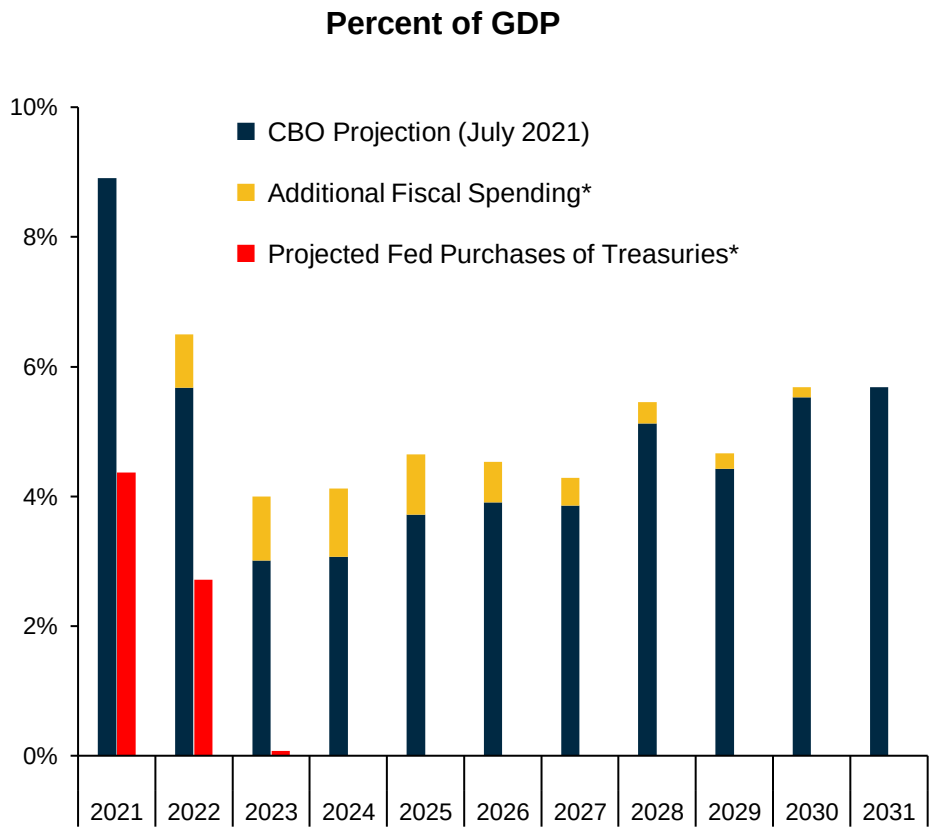
Federal Borrowing Requirements are Expected to Remain Large in Coming Years

- While Federal government borrowing needs are projected to decline as the economy recovers from the impact of the global pandemic over the next few years, they nonetheless are expected to remain quite large in historical terms.
- We assume additional fiscal packages are likely to be passed this year, resulting in additional aggregate net federal spending of $1.5 trillion through 2030 (over the next 9 years*). This would further add to Treasury's financing requirements in coming years.

Federal Government Net Borrowing Needs (Fiscal Year)

As of June 30, 2021





*Source: CBO and committee participant. * Based on committee participant's estimates.*

3. Coarse Auction Resizing Scenarios

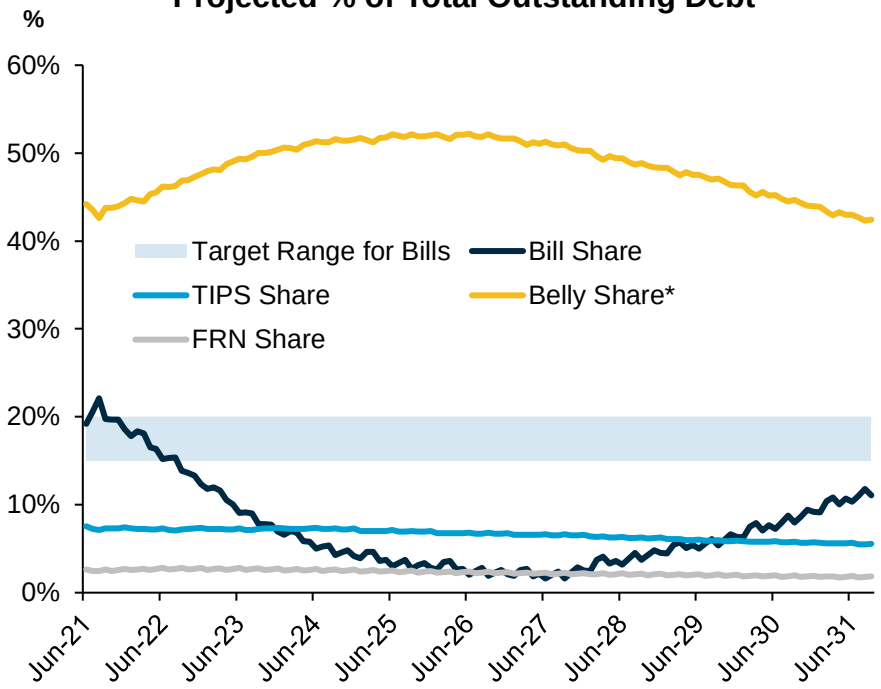
Scenario 1—Maintain Current Auction Schedule

- This scenario holds coupon issuance constant based on the most recent actual quarterly issuance cycle (May - July) totals.
- Under this scenario, Treasury will be significantly overfunded, the T-bill share will drop well outside the target range and the WAM and WAD will both extend longer
  - In this scenario T-bill share falls to approximately 2% in 2026-2027, a clearly unacceptable outcome
- TIPS share gradually declines as a percent of outstanding debt

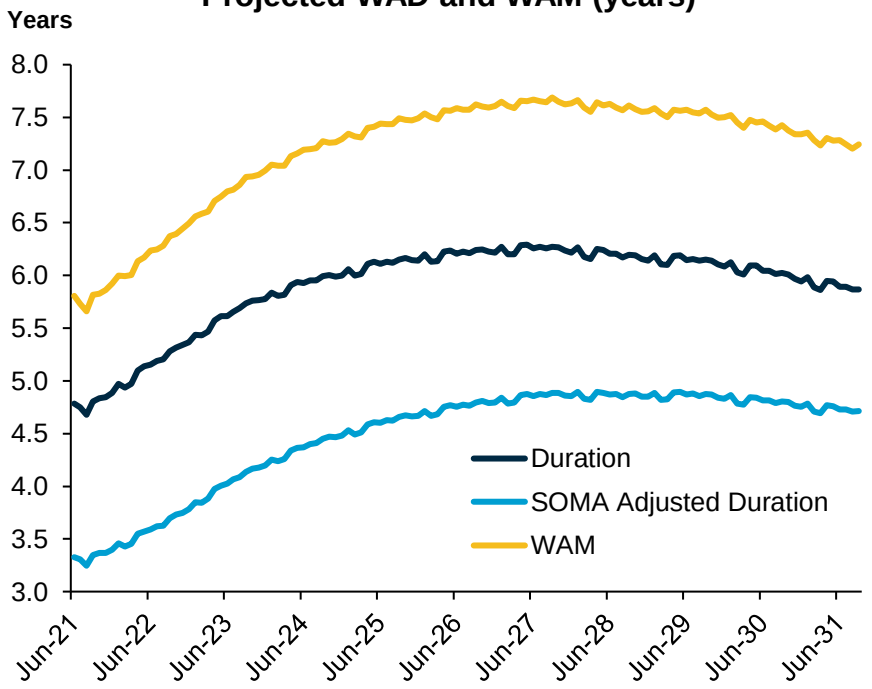
Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	720	696	732	744	468	300	300	68	88	18
2023	720	696	732	744	468	300	300	68	88	18
2024	720	696	732	744	468	300	300	68	88	18
2025	720	696	732	744	468	300	300	68	88	18
2026	720	696	732	744	468	300	300	68	88	18
2027	720	696	732	744	468	300	300	68	88	18
2028	720	696	732	744	468	300	300	68	88	18
2029	720	696	732	744	468	300	300	68	88	18
2030	720	696	732	744	468	300	300	68	88	18
2031	720	696	732	744	468	300	300	68	88	18

Projected % of Total Outstanding Debt



Projected WAD and WAM (years)



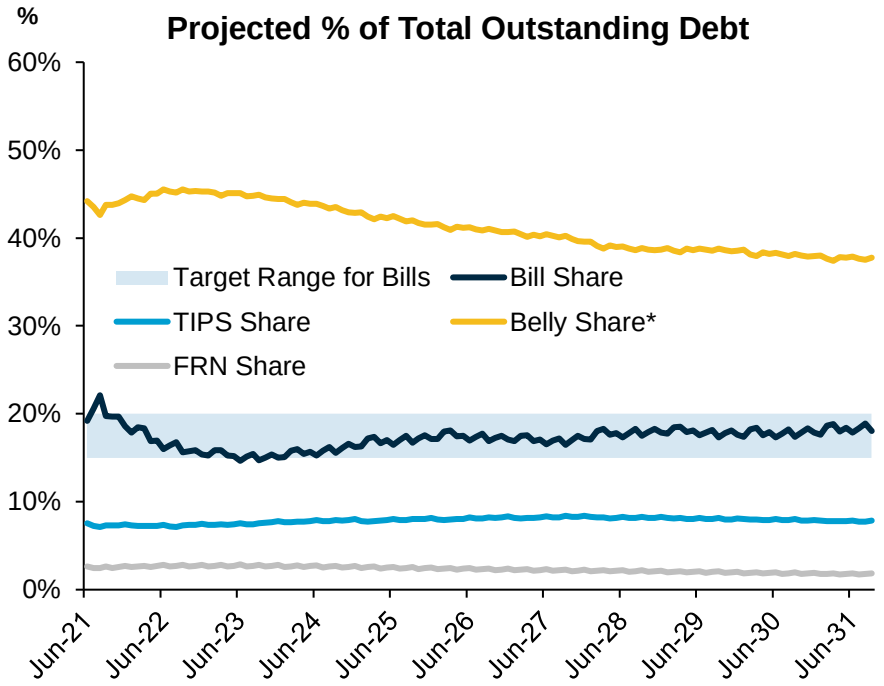
*Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.*

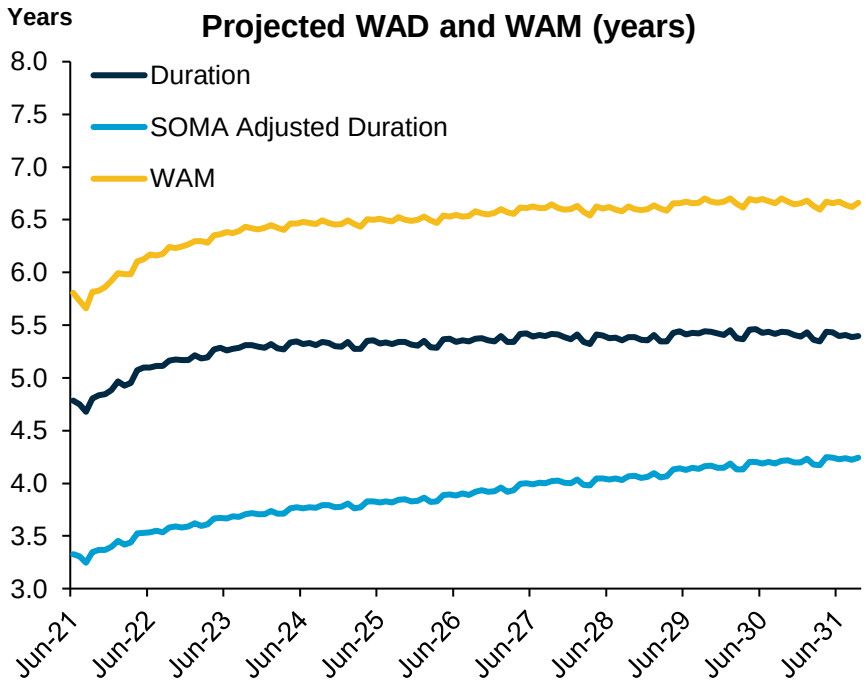
Scenario 2—Reduce Nominal Coupon Auction Sizes Pro-Rata

- This scenario is designed to serve as our initial baseline, incorporating the goal of maintaining T-bill share within the target range
- Nominal coupon auctions are reduced by 35% over the next 12 months to maintain T-bill share within the target range. Given current fiscal projections, nominal coupons would need to gradually increase beginning in 2025 to fund increasing deficits
- After these cuts, auction sizes will be largely in line with pre-COVID levels, with the exception of the 20-year which was re-introduced in May 2020 and accounts for nearly all of the aggregate increase in nominal coupons
- TIPS issuance is gradually increased to approximately 8%-9% share over the scenario horizon
- This scenario increases the WAM/duration profile over the projection horizon, although less so than in Scenario 1

Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
Current	720	696	732	744	468	300	300	68	88	18
2022	585	564	593	603	380	243	243	80	97	20
2023	468	456	480	480	308	200	200	92	109	22
2024	468	456	480	480	308	200	200	104	121	24
2025	489	471	495	504	318	204	204	116	133	26
2026	546	525	552	562	352	226	226	116	133	26
2027	576	552	588	600	372	240	240	116	133	26
2028	618	594	624	636	401	256	256	116	133	26
2029	669	645	678	690	434	280	280	116	133	26
2030	705	681	714	726	458	294	294	116	133	26
2031	720	696	732	744	468	300	300	116	133	26





*Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.*

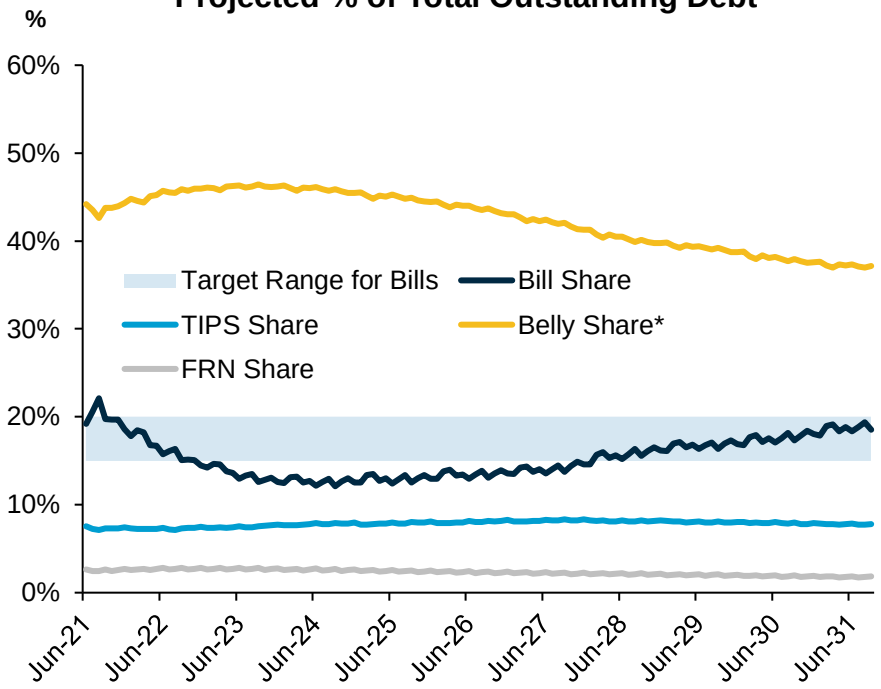
Scenario 2 ALT—Reduce Nominal Coupon Auction Sizes by a Smaller Pro-Rata Amount

- This alternative scenario allows T-bill share to drop outside the target range in order to keep nominal coupon auctions more stable over the horizon
- Nominal coupon auctions are reduced by 25% over the next 12 months and are then increased beginning in 2027
- Like Scenario 2, TIPS issuance is gradually increased to approximately 8%-9% share over the scenario horizon
- Relative to Scenario 2, this scenario has a lower T-bill share and a longer WAM/Duration in the early/middle years of the scenario horizon

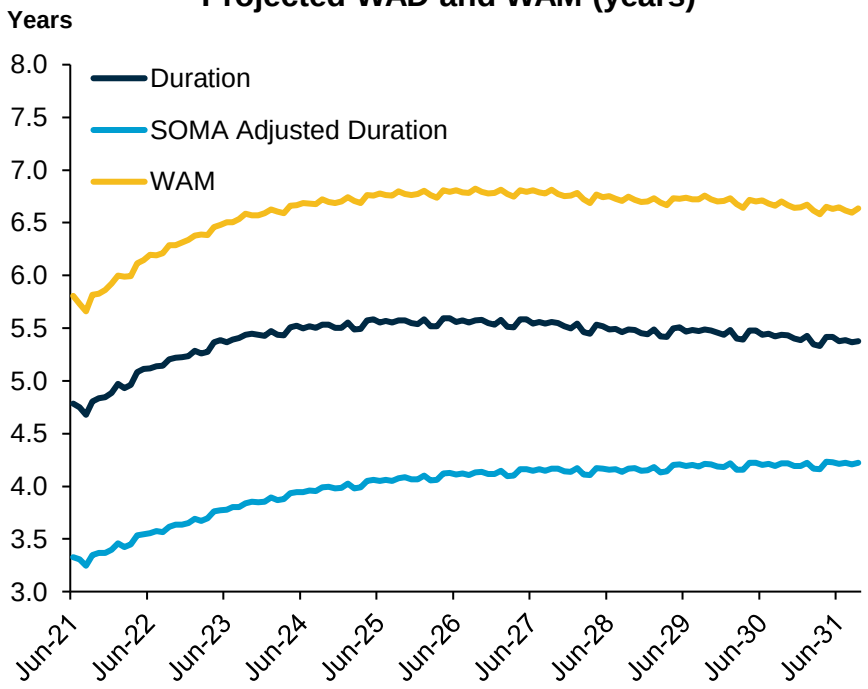
Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
Current	720	696	732	744	468	300	300	68	88	18
2022	624	603	633	644	405	262	262	80	97	20
2023	540	528	552	564	356	224	224	92	109	22
2024	540	528	552	564	356	224	224	104	121	24
2025	540	528	552	564	356	224	224	116	133	26
2026	540	528	552	564	356	224	224	116	133	26
2027	561	540	570	579	364	232	232	116	133	26
2028	597	576	606	615	388	249	249	116	133	26
2029	633	611	642	653	410	264	264	116	133	26
2030	669	645	678	690	434	280	280	116	133	26
2031	705	681	714	726	458	294	294	116	133	26

Projected % of Total Outstanding Debt



Projected WAD and WAM (years)



*Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.*

4. Demand Assessment of Auction Points

Framework for Assessing Relative Demand Across Auction Points

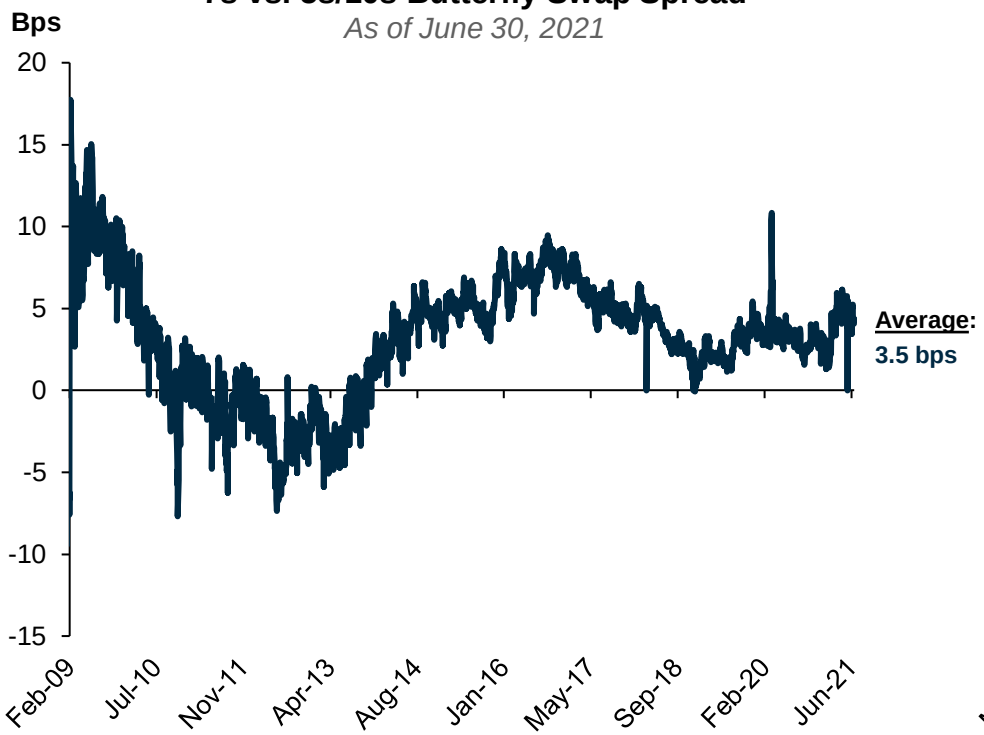
- Within a regular and predictable framework, Treasury may reduce its funding cost by adjusting issuance at curve points based on perceived relative demand.
  - Relative value measures are one method to gauge relative demand among auction points.
  - A key question is whether these relative demand indicators are transitory or persistent.
- The most liquid on-the-runs tend to trade at a greater liquidity premium and therefore Treasury can benefit by issuing a greater proportion of these highly liquid securities.
- In this section different relative cost measures will be used to identify the most highly sought after and attractive points for Treasury issuance.
  - First, a model independent method of measuring relative cost is employed using swap spreads.
  - Second, a committee participant term structure model is used to fit a fair value curve and relative cost is measured to that fair value curve. This second approach produces results consistent with the swap spread analysis.
  - A market repo analysis and a comparison of secondary trading volume with issuance are also presented to complement these relative cost analyses.
  - We focused our analysis on comparing 7s and 20s against butterflies of 5s, 10s and 30s.
- Finally, a committee participant term structure model is used to assess demand differences across auction points broadly.

Assessing Relative Demand Using Swap Spreads

- Swap spreads can provide a model independent method of identifying relative cost of specific auction points.
- Duration neutral butterflies of swap spreads indicate that:
  - On-the-run 7s have generally been cheap vs. a butterfly of on-the-run 5s and on-the-run 10s.
  - On-the-run 20s have generally been cheap vs. a butterfly of on-the-run 10s and on-the-run 30s.

7s vs. 5s/10s Butterfly Swap Spread

As of June 30, 2021



20s vs. 10s/30s Butterfly Swap Spread

As of June 30, 2021

Note: Re-introduced 7-year auctions in February 2009.
Re-introduced 20-year auctions in May 2020.
Swap spread is defined as on-the-run treasury yield minus corresponding LIBOR swap rate.

Source: Bloomberg and committee participant.

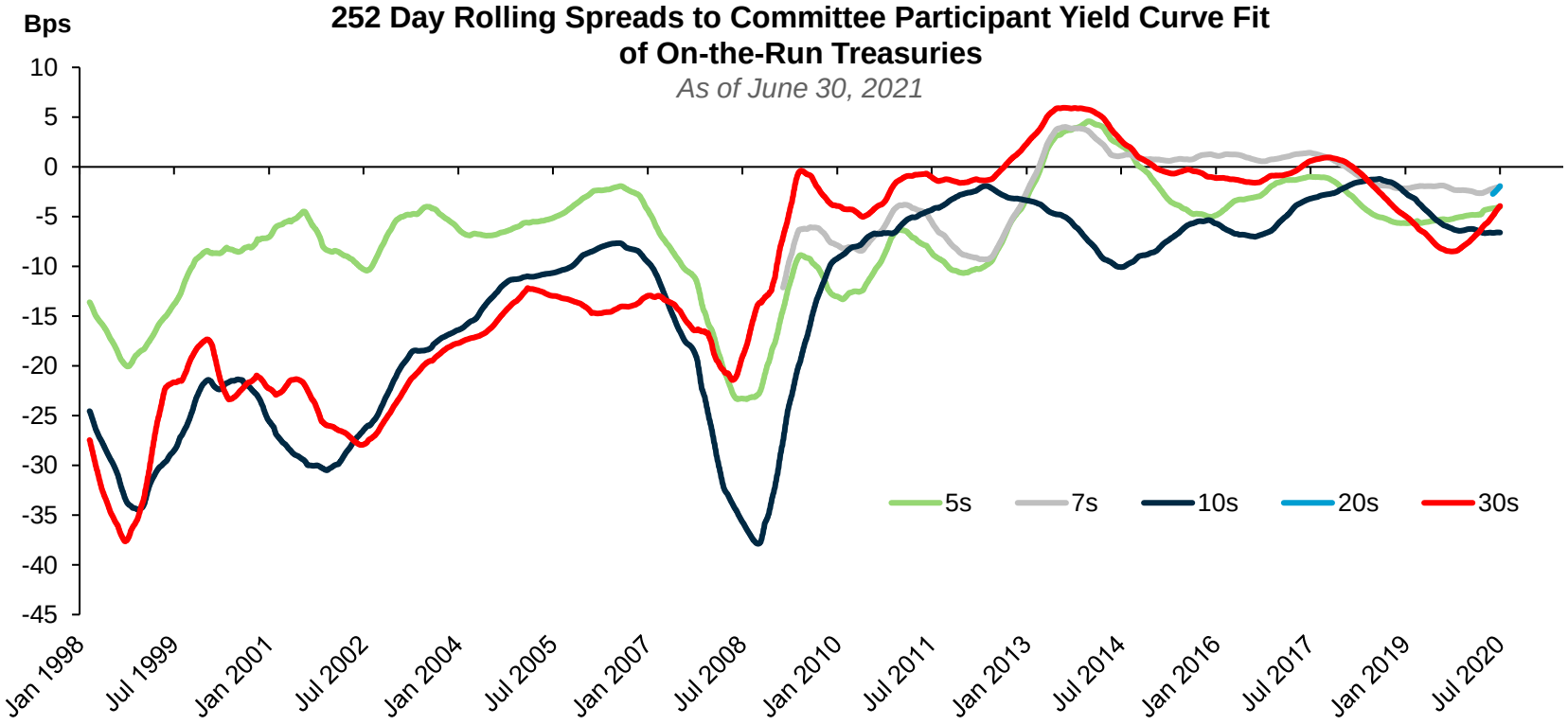
Assessing Relative Demand Using Fitted Treasury Yield Curve

- Committee participant fitted yield curve provides an estimate of the relative cost of specific auction points[1].
- The relative cost estimate of each on-the-run Treasury is shown below:

Average Spreads of On-the-Run Treasuries to Committee Participant Yield Curve Fit (Bps)

As of June 30, 2021

	5s	7s	10s	20s	30s
Average Since 2/27/1998	-7.0	N/A	-13.7	N/A	-10.4
Average Since 2/26/2009	-5.2	-2.7	-7.2	N/A	-1.7
Average Since 5/20/2020	-4.1	-2.0	-6.7	-2.3	-4.7

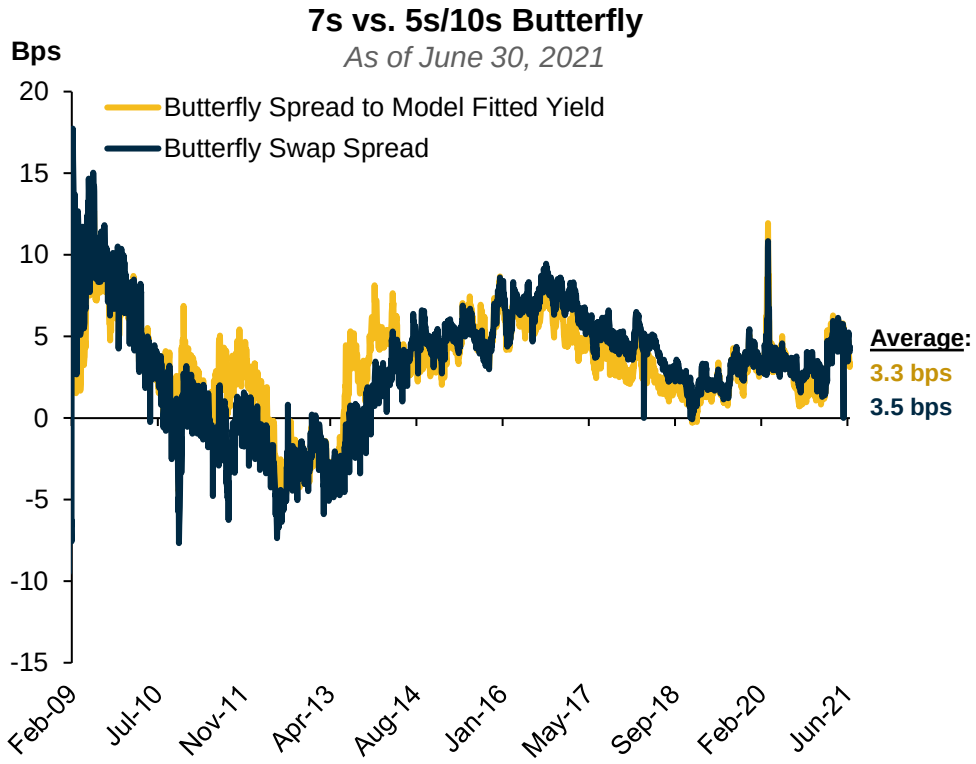


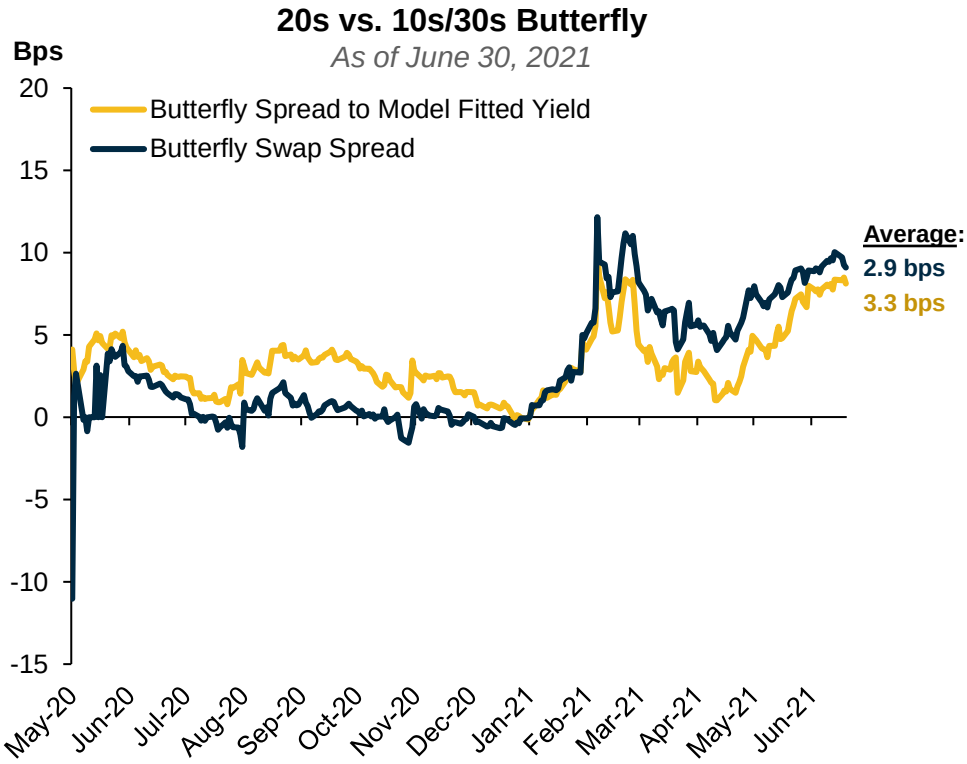
Note: Re-introduced 7-year auctions in February 2009.
Re-introduced 20-year auctions in May 2020.

Source: Committee participant model. [1] Presenting members model used for fitted Treasury yield is a proprietary stochastic term structure model which fits fair value for off the run Treasury bonds and bond volatility.

Assessing Relative Demand Using Fitted Treasury Yield Curve

- Duration neutral butterflies of these fitted yield deviations support the findings from the swap spread butterfly analysis:
  - On-the-run 7s have generally been cheap vs. a butterfly of on-the-run 5s and on-the-run 10s.
  - On-the-run 20s have generally been cheap vs. a butterfly of on-the-run 10s and on-the-run 30s.





Note: Re-introduced 7-year auctions in February 2009.
Re-introduced 20-year auctions in May 2020.
Swap spread is defined as on-the-run treasury yield minus corresponding LIBOR swap rate.

Source: Bloomberg and committee participant.

Assessing Market Demand Using Repo Rate Analysis

- On-the-run Treasury specialness is defined as the difference in financing costs to repo on-the-run Treasuries and off-the-run Treasuries.
- While explaining only a portion of the fitted yields, this provides additional support for the relative cost of on-the-run Treasuries.

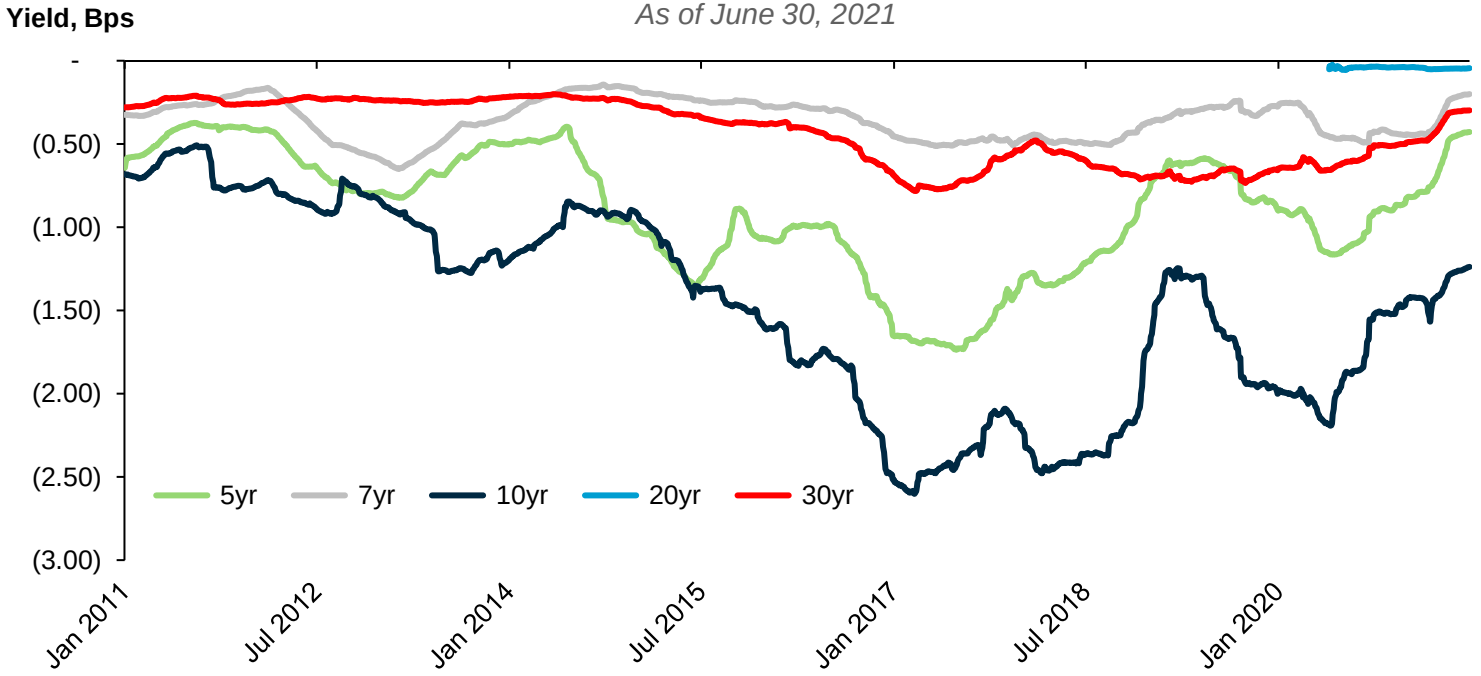
Yield Value of the Cumulative Repo Richness of On-The-Run Treasuries* (Price Yield, Bps)

As of June 30, 2021

	5s	7s	10s	20s	30s
Average Since 1/1/2010	(0.87)	(0.34)	(1.44)	--	(0.43)
Average Since 5/20/2020	(0.45)	(0.22)	(1.23)	(0.05)	(0.30)

252 Day Rolling Average of Yield Value of the Cumulative Repo Richness of On-The-Run Treasuries*

As of June 30, 2021



Note: Re-introduced 20-year auctions in May 2020.

*Source: Bloomberg, JPMorgan Markets. * Cumulative repo richness includes the repo richness of on-the-run until it becomes the 4th old.*

Assessing Market Demand Using Trading Volumes Relative to Auction Size

- Secondary Treasury trading volumes relative to issuance size are much higher in 5s and 10s than other nodes.
- Over the past 18 months, 54% of on-the-run Treasury trading volume has been in 5s and 10s, despite representing only 29% of the issuance.
- These are the most liquid points on the Treasury curve and this is likely due to MBS and corporate bond hedging activity.
- 30-year trading volume is more than double 20-year trading volume despite equal issuance amounts. Furthermore, 30-year on-the-run volume understates the liquidity demands at the 30-year point because 30-year corporates are priced/hedged using the once old 30-year.
- Investors are willing to accept a lower yield for these more liquid securities.
- This suggests there is capacity for Treasury to consider issuing a greater proportion in 5s, 10s and 30s and benefit more from the richness of these points.

Trading Volumes and Issuance

January 1, 2020 – June 30, 2021

	Treasury Volume	Treasury Issuance	Trading $ / Issuance $*
2s	13%	17%	16.63
3s	12%	17%	16.89
5s	**29%**	**18%**	**36.83**
7s	**10%**	**18%**	**13.24**
10s	**26%**	**11%**	**52.10**
> 10Y	8%	15%	12.47
TIPS	2%	4%	13.52

Trading Volumes and Issuance

May and June 2021

	Treasury Volume	Treasury Issuance	Trading $ / Issuance $*
2s	11%	17%	16.12
3s	13%	17%	19.69
5s	**28%**	**18%**	**38.53**
7s	**10%**	**18%**	**13.95**
10s	**25%**	**11%**	**54.53**
20s	**3%**	**7%**	**11.65**
30s	**7%**	**7%**	**23.09**
TIPS	3%	4%	15.36

Notes on Data Provided:

- FINRA has provided trading volume statistics for 20-year on the runs since May 2021.
- Since this period is so short, we compare the trading volumes of the prior 18 months to show that May and June 2021 period is representative of the longer period.

*Source: FINRA and TRACE. *Annualized Treasury on-the-run trading volume divided by annualized issuance volume.*

Assessing Relative Demand Across Broad Yield Curve Segments*

- Committee participant fitted Treasury and fitted Swap yield curves are compared to assess demand differences across the yield curve broadly.
- Before the global financial crisis, Treasuries consistently traded at lower yields than Swaps across the entire yield curve.
  - Swap spreads were generally flat across the term structure.
- Since then, Swap spreads have been significantly lower.
  - The Treasury curve has been persistently steeper than the Swap curve.

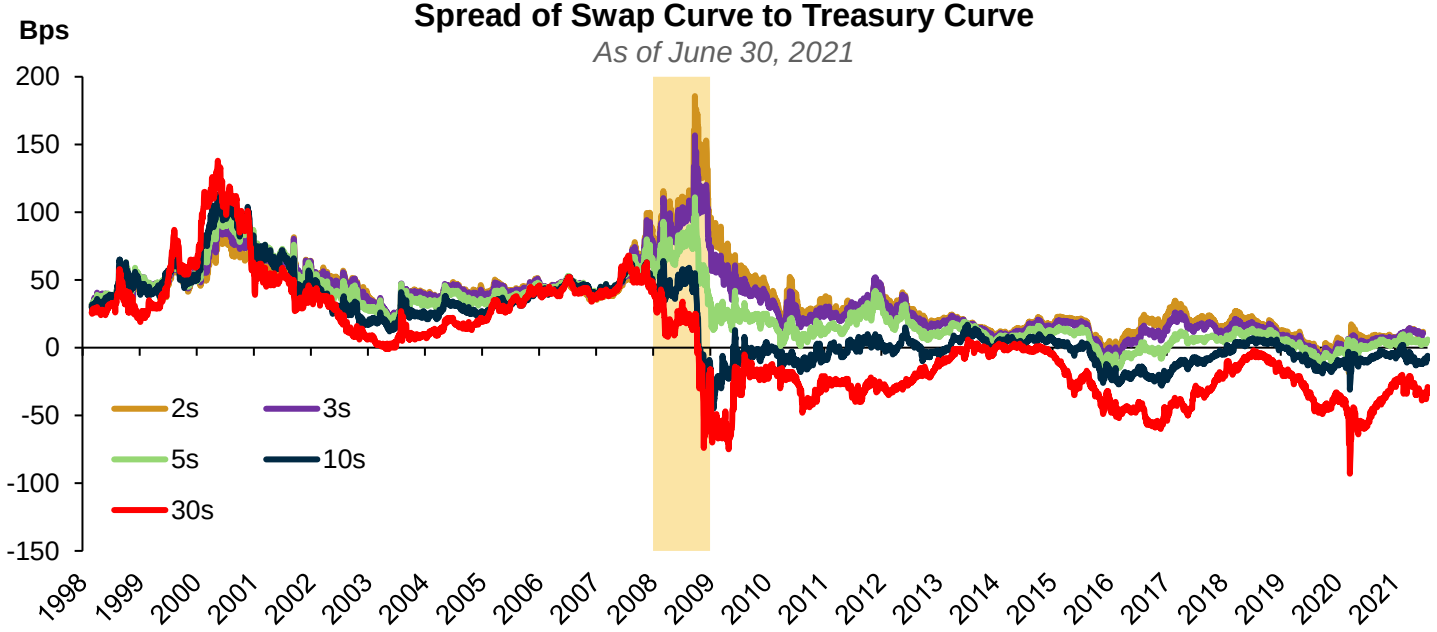
Average Spread of Swap Curve to Treasury Curve (Bps)

As of June 30, 2021

	2s	3s	5s	10s	30s
Average From 2/27/1998 to 12/31/2007	48	50	49	45	40
Average From 1/1/2009 to 6/30/2021	21	17	9	-5	-27

Spread of Swap Curve to Treasury Curve

As of June 30, 2021



*Source: Committee participant model. * For a more in-depth discussion, see previous TBAC charge from February 2021.*

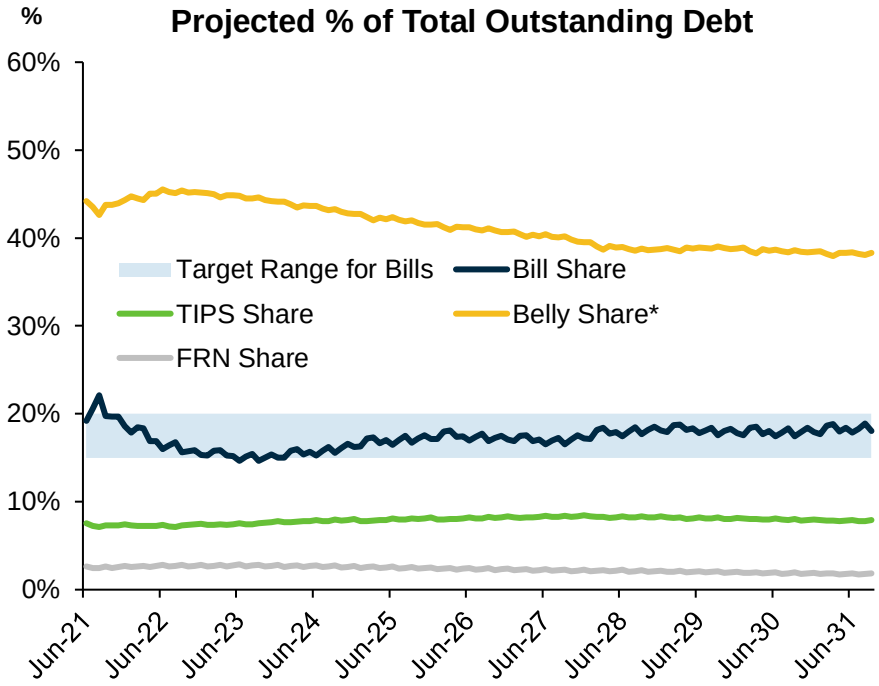
5. Fine Tuning Auction Adjustment Scenarios

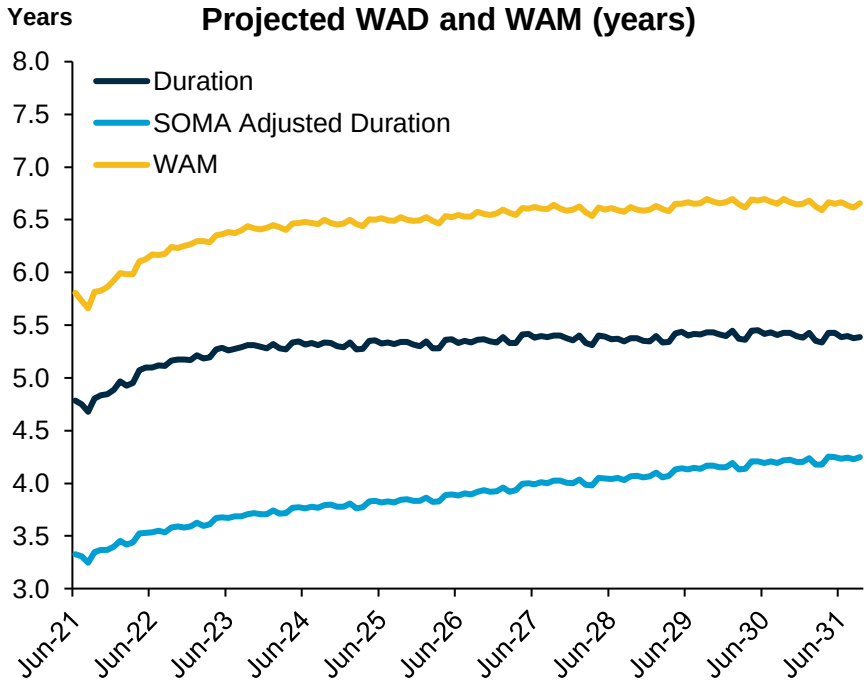
Scenario 3—Relative Market Demand Adjustments

- Given the preceding relative market demand analysis, this scenario further reduces the 7 and 20-year auctions relative to Scenario 2. For illustrative purposes, 7-year auctions are reduced by approximately $100bn and 20-year auctions are reduced by approximately $50bn, annually
- Offsetting increases are made to the 5, 10 and 30-year auctions using a par weighted butterfly approach
- We reduced the 20-year auction by a smaller amount to ensure sufficient liquidity at the 20-year point
- This method has little impact on WAM/duration profile, as well as belly share and T-bill share of the outstanding debt, relative to Scenario 2, while likely achieving a lower cost of issuance

Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
Current	720	696	732	744	468	300	300	68	88	18
2022	585	564	619	549	422	217	257	80	97	20
2023	468	456	528	384	380	152	224	92	109	22
2024	468	456	528	384	380	152	224	104	121	24
2025	489	471	543	408	390	156	228	116	133	26
2026	546	525	600	466	424	178	250	116	133	26
2027	576	552	636	504	444	192	264	116	133	26
2028	618	594	672	540	473	208	280	116	133	26
2029	669	645	726	594	506	232	304	116	133	26
2030	705	681	762	630	530	246	318	116	133	26
2031	720	696	780	648	540	252	324	116	133	26





Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.

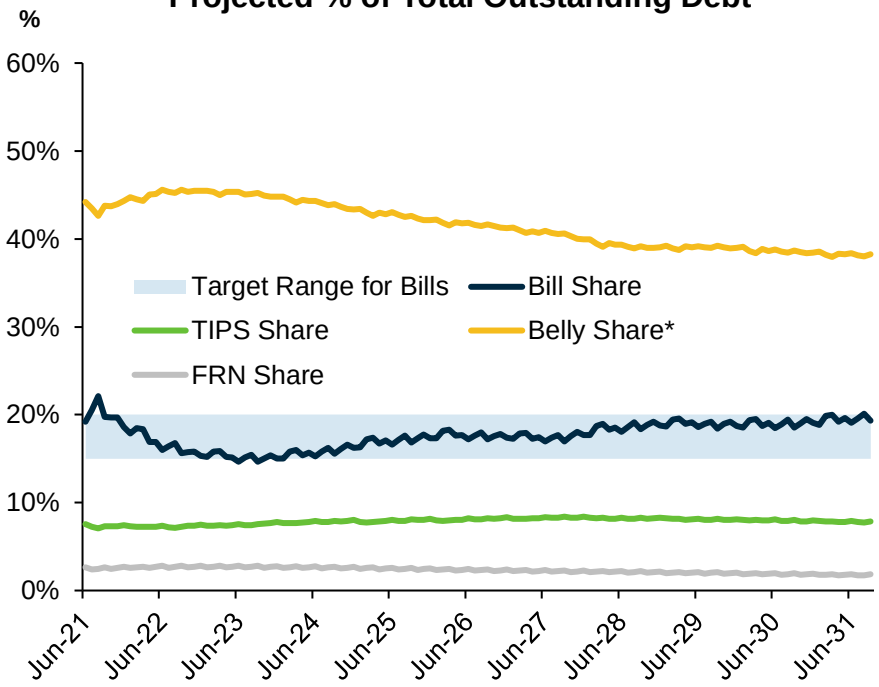
Scenario 4—Increase the Belly Share

- This scenario increases the belly share of the debt, as favored by the TBAC Optimal Debt Model, while making an offsetting decrease of long end issuance
- For illustrative purposes, in this scenario we modify Scenario 3 to reallocate approximately $100bn of issuance from 10s, 20s and 30s to 2s, 3s, 5s and 7s
- This scenario results in a decrease in the WAM/duration profile relative to Scenarios 2 and 3, while also potentially reducing term premia costs

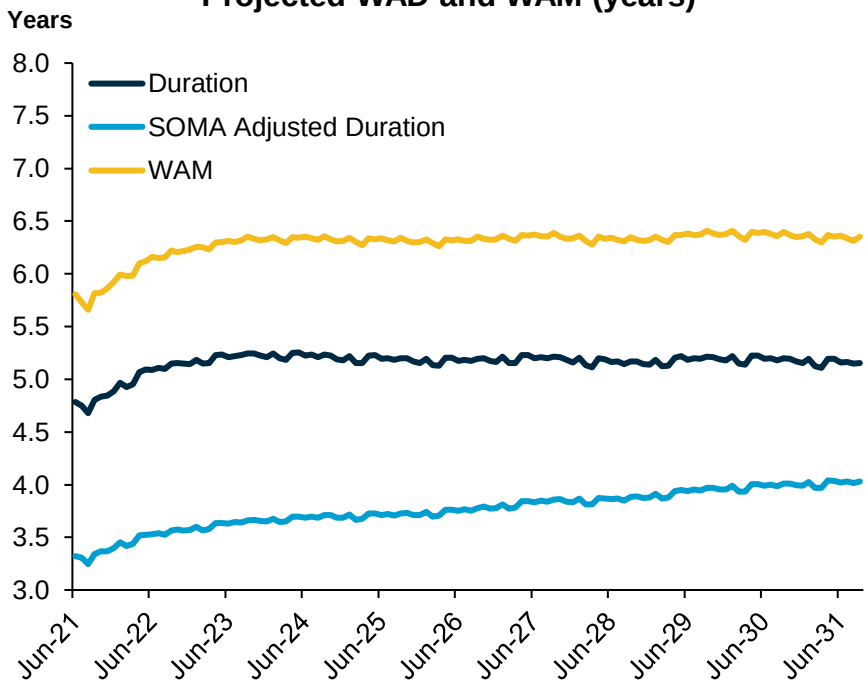
Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
Current	720	696	732	744	468	300	300	68	88	18
2022	599	578	634	562	396	205	242	80	97	20
2023	492	480	552	408	332	128	200	92	109	22
2024	492	480	552	408	332	128	200	104	121	24
2025	513	495	567	432	342	132	204	116	133	26
2026	570	549	624	490	376	154	226	116	133	26
2027	600	576	660	528	396	168	240	116	133	26
2028	642	618	696	564	425	184	256	116	133	26
2029	693	669	750	618	458	208	280	116	133	26
2030	729	705	786	654	482	222	294	116	133	26
2031	744	720	804	672	492	228	300	116	133	26

Projected % of Total Outstanding Debt



Projected WAD and WAM (years)



Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.

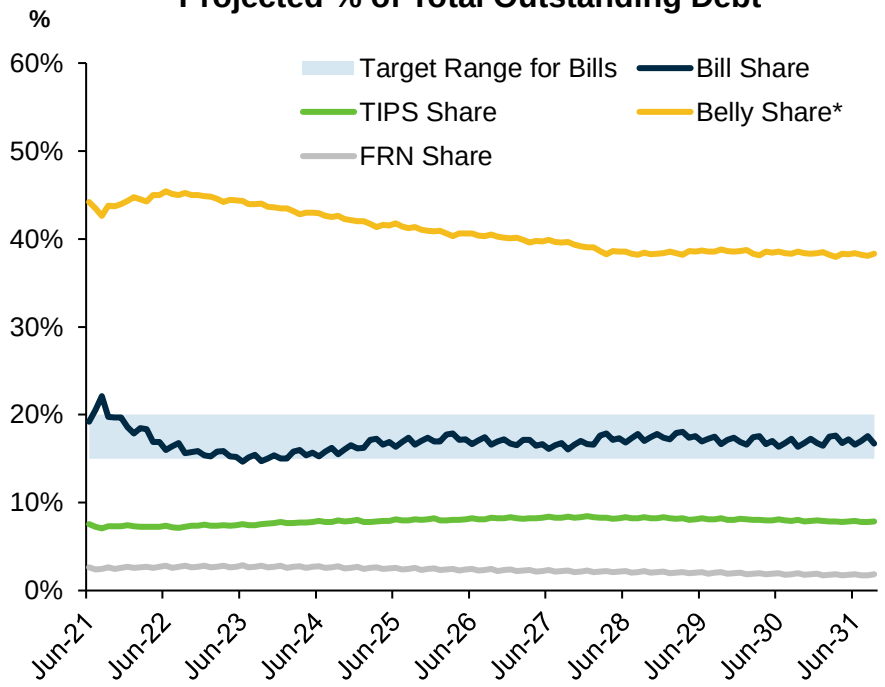
Scenario 5—Decrease the Belly Share

- This scenario decreases the belly share of the debt, to reduce the uncertainty of interest costs in future budgets, while making an offsetting increase of long end issuance
- For illustrative purposes, in this scenario we modify Scenario 3 to reallocate approximately $100bn of issuance from 2s, 3s, 5s and 7s to 10s, 20s and 30s
- This scenario results in an increase in the WAM/duration profile relative to Scenarios 2 and 3, although it potentially increases term premia costs

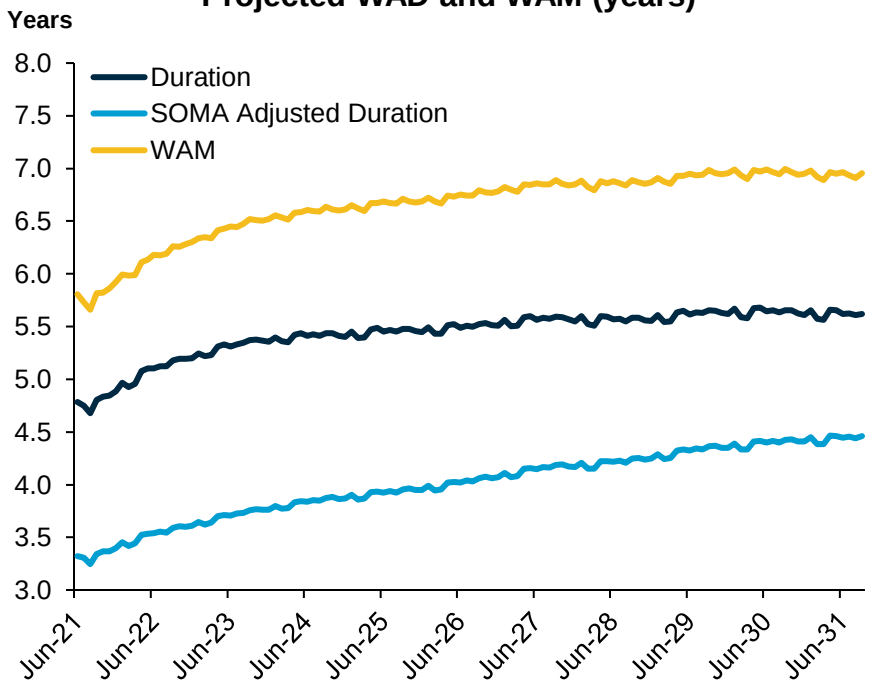
Assumed Annual Issuance Schedule ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
Current	720	696	732	744	468	300	300	68	88	18
2022	571	550	604	536	448	229	272	80	97	20
2023	444	432	504	360	428	176	248	92	109	22
2024	444	432	504	360	428	176	248	104	121	24
2025	465	447	519	384	438	180	252	116	133	26
2026	522	501	576	442	472	202	274	116	133	26
2027	552	528	612	480	492	216	288	116	133	26
2028	594	570	648	516	521	232	304	116	133	26
2029	645	621	702	570	554	256	328	116	133	26
2030	681	657	738	606	578	270	342	116	133	26
2031	696	672	756	624	588	276	348	116	133	26

Projected % of Total Outstanding Debt

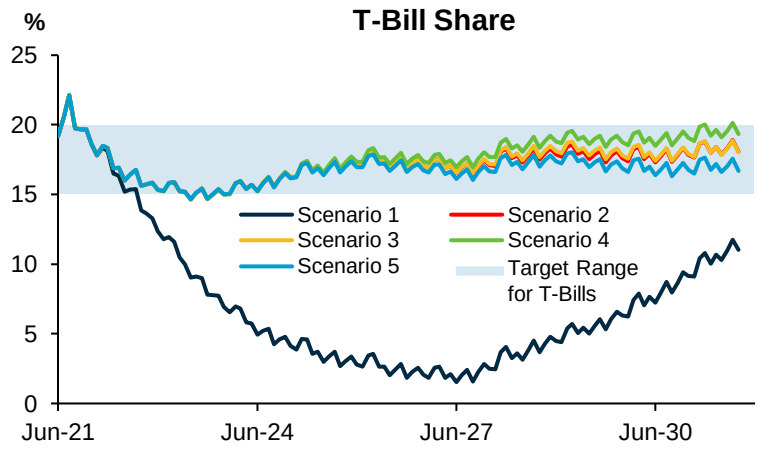


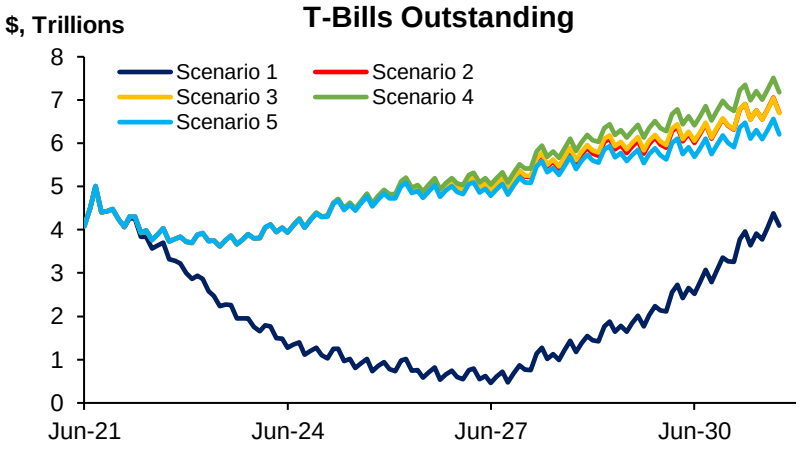
Projected WAD and WAM (years)

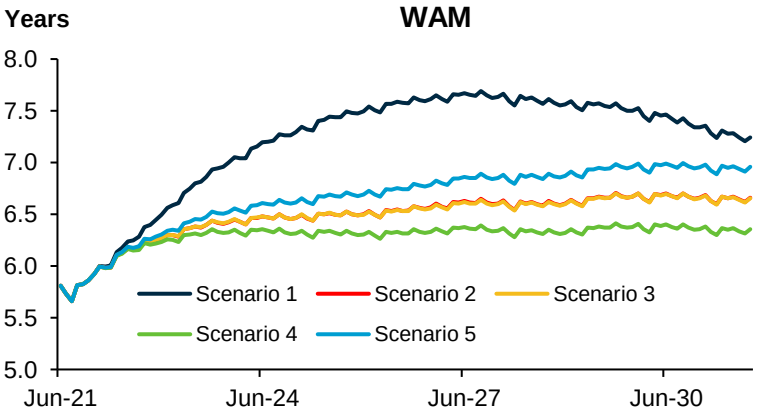


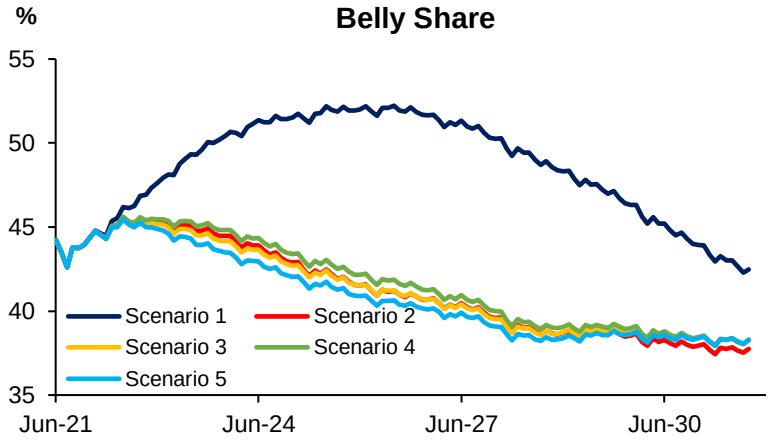
Source: Committee participant. * Note: Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years.

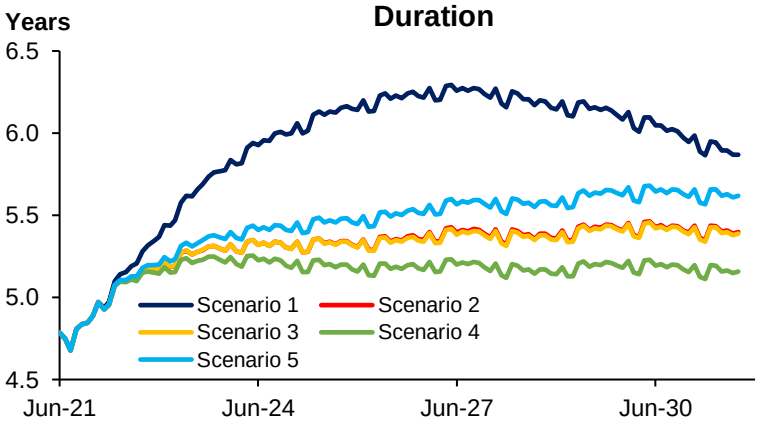
Summary of Scenarios

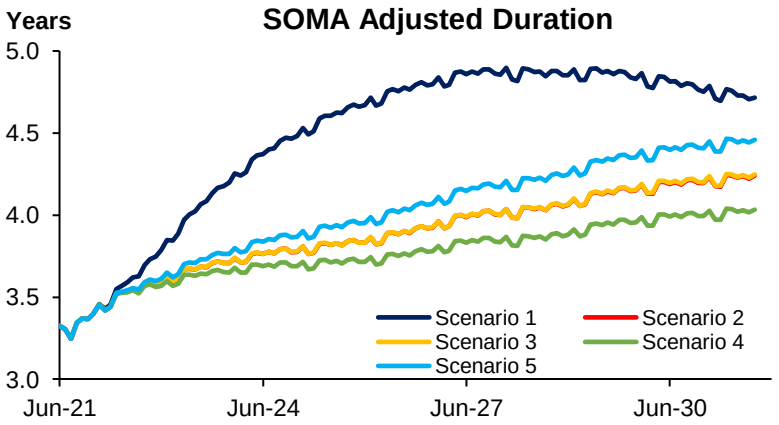












Scenario 1

Flat issuance

Scenario 2*

35% Pro-rata cut
(with issuance gradually increasing starting in 2025)

Scenario 3

Scenario 2 +
RV adjustment

Scenario 4

Scenario 3 +
Increased belly share

Scenario 5

Scenario 3 +
Decreased belly share

As of June 30, 2021. Source: Committee participant. Belly share is defined as the % of outstanding debt with remaining maturity greater than 1 year and less than 8.5 years. * Where Scenario 2 is not visible, it is being hidden by the Scenario 3 line.

6. Additional Considerations

Other Considerations

- Treasury is faced with a number of significant uncertainties and must continue to maintain a flexible approach.
  - Major fiscal policy initiatives can significantly alter the future path of fiscal deficits, creating uncertainty around Treasury funding requirements; examples include fiscal packages currently under discussion as well as potential extensions of household tax cuts when they expire at the end of 2025.
  - Differences between actual and CBO's projected paths of real GDP can be expected to result in unanticipated changes in Treasury's funding needs.
  - In addition, given elevated levels of debt/GDP, interest rate volatility also introduces greater uncertainty looking forward.
  - Finally, the Federal Reserve's balance sheet policies over time add additional uncertainty to Treasury's future funding needs.
- Treasury’s implementation of its regular and predictable philosophy should consider both uncertain funding requirements and the need to maintain sufficient outstanding supply of T-bills.

7. Conclusions and Recommendations

Conclusions and Recommendations

- The current auction schedule would likely leave Treasury significantly overfunded.
- Issuance will need to be cut in coming years to maintain a reasonable share of T-bills.
- Choosing between Scenario 2 and Scenario 2-ALT is a trade-off between maintaining T-bill share within the target range and keeping nominal coupon auctions more stable over time.
  - Scenario 2 maintains more stability in the share of T-bills and adjusts coupons gradually over a one year time frame. This approach recognizes the significant fiscal uncertainty Treasury faces and the historically large current size of coupon auctions.
  - The presenting member favors initially sizing coupon reductions consistent with Scenario 2-ALT, thereby leaving flexibility for further reductions later if needed.
- The presenting member recommends a reduction in 7 and 20-year issuance, with offsetting adjustments to 5, 10 and 30-year auctions as illustrated in Scenario 3. We recommend that Treasury make these adjustments gradually over time while observing market feedback and adhering to regular and predictable principles.
- Choosing between Scenarios 4 and 5 is a trade-off between potentially increasing term premia costs and the uncertainty of interest costs in future budgets.
  - The TBAC optimal debt model favors increasing belly share and, therefore, would tend to favor Scenario 4.
  - Given all the elements of uncertainty that Treasury faces, the presenting member favors the adjustments implied in Scenario 5 to reduce the uncertainty of interest costs in future budgets.
- The scenarios presented are illustrative and meant to convey both a guiding framework and a general direction for auction adjustments.
  - We recommend that Treasury consider implementing near term auction changes with an eye on long term debt dynamics (T-bill share, belly share, WAM, and duration).
  - While more distant years are of course more uncertain, looking at these long-term projections can provide insights into how debt characteristics may evolve over time.
- In practice, when implementing specific auction adjustments, Treasury should consider both changing fiscal dynamics and market factors, while keeping changes gradual, well telegraphed, and in keeping with regular and predictable principles.

8. Appendix

Summary—Change in Gross Issuance from Scenario 1 (in $bn)

Scenario 2 ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-135	-132	-139	-141	-88	-57	-57	12	9	2
2023	-252	-240	-252	-264	-160	-100	-100	24	21	4
2024	-252	-240	-252	-264	-160	-100	-100	36	33	6
2025	-231	-225	-237	-240	-150	-96	-96	48	45	8
2026	-174	-171	-180	-182	-116	-74	-74	48	45	8
2027	-144	-144	-144	-144	-96	-60	-60	48	45	8
2028	-102	-102	-108	-108	-67	-44	-44	48	45	8
2029	-51	-51	-54	-54	-34	-20	-20	48	45	8
2030	-15	-15	-18	-18	-10	-6	-6	48	45	8
2031	0	0	0	0	0	0	0	48	45	8

Scenario 3 ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-135	-132	-113	-195	-46	-83	-43	12	9	2
2023	-252	-240	-204	-360	-88	-148	-76	24	21	4
2024	-252	-240	-204	-360	-88	-148	-76	36	33	6
2025	-231	-225	-189	-336	-78	-144	-72	48	45	8
2026	-174	-171	-132	-278	-44	-122	-50	48	45	8
2027	-144	-144	-96	-240	-24	-108	-36	48	45	8
2028	-102	-102	-60	-204	5	-92	-20	48	45	8
2029	-51	-51	-6	-150	38	-68	4	48	45	8
2030	-15	-15	30	-114	62	-54	18	48	45	8
2031	0	0	48	-96	72	-48	24	48	45	8

Scenario 4 ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-121	-118	-98	-182	-72	-95	-58	12	9	2
2023	-228	-216	-180	-336	-136	-172	-100	24	21	4
2024	-228	-216	-180	-336	-136	-172	-100	36	33	6
2025	-207	-201	-165	-312	-126	-168	-96	48	45	8
2026	-150	-147	-108	-254	-92	-146	-74	48	45	8
2027	-120	-120	-72	-216	-72	-132	-60	48	45	8
2028	-78	-78	-36	-180	-43	-116	-44	48	45	8
2029	-27	-27	18	-126	-10	-92	-20	48	45	8
2030	9	9	54	-90	14	-78	-6	48	45	8
2031	24	24	72	-72	24	-72	0	48	45	8

Scenario 5 ($bn)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-149	-146	-128	-208	-20	-71	-28	12	9	2
2023	-276	-264	-228	-384	-40	-124	-52	24	21	4
2024	-276	-264	-228	-384	-40	-124	-52	36	33	6
2025	-255	-249	-213	-360	-30	-120	-48	48	45	8
2026	-198	-195	-156	-302	4	-98	-26	48	45	8
2027	-168	-168	-120	-264	24	-84	-12	48	45	8
2028	-126	-126	-84	-228	53	-68	4	48	45	8
2029	-75	-75	-30	-174	86	-44	28	48	45	8
2030	-39	-39	6	-138	110	-30	42	48	45	8
2031	-24	-24	24	-120	120	-24	48	48	45	8

Summary—Change in Gross Issuance from Scenario 1 (in %)

Scenario 2 (%)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-19	-19	-19	-19	-19	-19	-19	18	10	11
2023	-35	-34	-34	-35	-34	-33	-33	35	24	22
2024	-35	-34	-34	-35	-34	-33	-33	53	38	33
2025	-32	-32	-32	-32	-32	-32	-32	71	51	44
2026	-24	-25	-25	-24	-25	-25	-25	71	51	44
2027	-20	-21	-20	-19	-21	-20	-20	71	51	44
2028	-14	-15	-15	-15	-14	-15	-15	71	51	44
2029	-7	-7	-7	-7	-7	-7	-7	71	51	44
2030	-2	-2	-2	-2	-2	-2	-2	71	51	44
2031	0	0	0	0	0	0	0	71	51	44

Scenario 3 (%)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-19	-19	-15	-26	-10	-28	-14	18	10	11
2023	-35	-34	-28	-48	-19	-49	-25	35	24	22
2024	-35	-34	-28	-48	-19	-49	-25	53	38	33
2025	-32	-32	-26	-45	-17	-48	-24	71	51	44
2026	-24	-25	-18	-37	-9	-41	-17	71	51	44
2027	-20	-21	-13	-32	-5	-36	-12	71	51	44
2028	-14	-15	-8	-27	1	-31	-7	71	51	44
2029	-7	-7	-1	-20	8	-23	1	71	51	44
2030	-2	-2	4	-15	13	-18	6	71	51	44
2031	0	0	7	-13	15	-16	8	71	51	44

Scenario 4 (%)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-17	-17	-13	-24	-15	-32	-19	18	10	11
2023	-32	-31	-25	-45	-29	-57	-33	35	24	22
2024	-32	-31	-25	-45	-29	-57	-33	53	38	33
2025	-29	-29	-23	-42	-27	-56	-32	71	51	44
2026	-21	-21	-15	-34	-20	-49	-25	71	51	44
2027	-17	-17	-10	-29	-15	-44	-20	71	51	44
2028	-11	-11	-5	-24	-9	-39	-15	71	51	44
2029	-4	-4	2	-17	-2	-31	-7	71	51	44
2030	1	1	7	-12	3	-26	-2	71	51	44
2031	3	3	10	-10	5	-24	0	71	51	44

Scenario 5 (%)

Calendar Year	2Y	3Y	5Y	7Y	10Y	20Y	30Y	5Y TIPS	10Y TIPS	30Y TIPS
2022	-21	-21	-17	-28	-4	-24	-9	18	10	11
2023	-38	-38	-31	-52	-9	-41	-17	35	24	22
2024	-38	-38	-31	-52	-9	-41	-17	53	38	33
2025	-35	-36	-29	-48	-6	-40	-16	71	51	44
2026	-28	-28	-21	-41	1	-33	-9	71	51	44
2027	-23	-24	-16	-35	5	-28	-4	71	51	44
2028	-18	-18	-11	-31	11	-23	1	71	51	44
2029	-10	-11	-4	-23	18	-15	9	71	51	44
2030	-5	-6	1	-19	24	-10	14	71	51	44
2031	-3	-3	3	-16	26	-8	16	71	51	44